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A review of the neotropical bee subgenus *Ctenaugochlora* (Hymenoptera: Halictidae)

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Abstract. – The rare bee subgenus *Ctenaugochlora* Eickwort (Halictinae: Augochlorini: *Caenaugochlora* Michener) is reviewed and the species figured and diagnosed, with several new records reported for *Caenaugochlora* (*Ctenaugochlora*) *beethoveni* Engel and *C*. (*C*.) *perviridis* Engel and Gonçalves. Four new species are described and figured from Costa Rica as *C*. (*C*.) *incompleta* Engel **n**. **sp**.; *C*. (*C*.) *raritas* Engel **n**. **sp**.; *C*. (*C*.) *formosa* Engel **n**. **sp**.; and *C*. (*C*.) *mediopolita* Engel **n**. **sp**. A key is provided to the species of the subgenus.

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Introduction

The genus *Caenaugochlora* Michener, 1954 (Augochlorini) is a relatively widespread genus of bees ranging from Mexico to Ecuador and east across northern South America to Venezuela and Trinidad (Michener, 2007; Engel, 2014a, 2019). While a few species are rather common, such as *Caenaugochlora* (*Caenaugochlora*) *costaricensis* (Friese, 1907) and *C*. (*C*.) *inermis* (Vachal, 1904), many are infrequently encountered and challenging to identify. The genus was established for the Panamanian species *C*. (*C*.) *macswaini* Michener, 1954, with an additional species placed in a separate subgenus, *Pseudaugochlora* Michener, 1954 (Michener, 1954). *Pseudaugochlora* was later recognized to be unrelated and elevated to generic status, while other subgenera were established to accommodate the growing number of species and morphological disparity of *Caenaugochlora* (*e.g*., Eickwort, 1969; Engel, 2000, 2014b; Gonçalves & Engel, 2010). Table 1 summarizes the current diversity within the genus.

The most distinctive of the subgenera is *Ctenaugochlora* Eickwort, 1969, a group most diverse in Central America but with a single occurrence in Ecuador. Though the bees outwardly look like typical species of the genus, the inner metatibial spur is densely pectinate with more than 10 elongate branches and with the medial base expanded at the origin of the first branch (Fig. 1-4). This comb-like spur gives the subgenus its name and permits females to be immediately distinguished from all other groups of *Caenaugochlora*. Males are a bit more challenging to associate and, in fact, males are only known for two species of the subgenus [*C. perpectinata* (Michener, 1954) and *C. formosa* **n**. **sp**.] meaning that it remains to be fully determined whether the slight differences in sternal characters do not vary (Eickwort, 1969). For the present, the characters of the male summarized in the diagnosis (*vide infra*) hold but need to be tested by the discovery of the male sex for the other species of the subgenus.

Material of *Ctenaugochlora* has accumulated slowly over the last 25 years, some of which was reported previously (Engel & Gonçalves, 2010; Engel, 2019). As no further material has come forth in recent exploration of collections or from the field, I provide here a brief review of the subgenus in order to bring the species to the awareness of melittologists. It is hoped that in providing a means by which these bees can be recognized from among their congeners and loosely similar genera, further material may be discovered and the nests and biology of these bees be explored, particularly any floral associations and the function of the densely pectinate metatibial spur.

Material and Methods

Material of *Ctenaugochlora* is rare in collections and may sometimes be misplaced amid typical *Caenaugochlora* s. str. or sometimes among *Neocorynura* Schrottky, 1910. Specimens were found in the following institutional collections, including types of previously described species:

AMNH, Division of Invertebrate Zoology, American Museum of Natural History, New York, New York;

CUIC, Cornell University Insect Collection, Department of Entomology, Cornell University, Ithaca, New York;

FSCA, Florida State Collection of Arthropods, Gainesville, Florida;

INBIO, Instituto Nacional de Biodiversidad, Santo Domingo, Heredia, Costa Rica;

LACM, Department of Entomology, Los Angeles County Museum, Los Angeles, California;

SEMC, Snow Entomological Collection, Division of Entomology, University of Kansas Natural History Museum, Lawrence, Kansas.

Descriptive morphological terminology follows that of Eickwort (1969), Engel (2000, 2001), Michener (2007), and Engel et al. (2021), with terms associated with tibial spur elements derived from Engel

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(2009a) and Engel et al. (2017). The course of the epistomal sulcus across the face is divided into distinct sections. The basal portion that runs between the subantennal sulci and abuts the apical portion of the frons is the frontoclypeal sulcus. Lateral to the frontoclypeal sulcus there have been two terms for different sections as these define the mesal and apical boundaries of the epistomal lobe, when such a lobe is present, and together form an angle (opening laterally) of various degrees of development with the elongate anterior tentorial pit at the vertex (strongly acute in groups like *Augochlora* Smith, 1853 or *Chlerogelloides* Engel, Brooks, and Yanega, 1997 all the way to broadly obtuse in genera such as *Corynura* Spinola, 1851 and *Neocorynura*). Traditionally, these two sections have been termed the dorsal clypeo-genal sulcus and the lateral clypeo-genal sulcus (Eickwort, 1969). I find the former of these terms to be unfortunate. The "dorsal" section is in a lateral position relative to the clypeus and is actually basal and mesal to the "lateral" section, which itself is in a transverse, lateral, and more apical orientation relative to its "dorsal" sister. Accordingly, I adopt the term mesal clypeo-genal sulcus for that portion traditionally referred to as "dorsal". Of course, this remains problematic as that portion of the integument abutting the mesal clypeo-genal sulcus is likely a contact between the intercalate and integument from the antennal segment, and therefore likely not the actual gena (Nel et al., 2025). Given that the precise segmental boundaries of the integument below the level of the antennal toruli and lateral to the clypeus remain to be determined for Aculeata, I retain the "clypeo-genal" portion of the term. In addition, I use the terms postclypeus and anteclypeus, when necessary, for those parts of the clypeus basal and apical, respectively, of a transverse tangent between the anterior tentorial pits.

The formats for the description and diagnoses are adapted from those used elsewhere in Augochlorini (*e.g*., Engel 1995b, 2014b). Given that the original descriptions of previously described species are lengthy, detailed, and nothing new need be added to or removed from those accounts, such species are merely diagnosed herein. Photographs of specimens were prepared with a Canon 7D digital camera and Infinity K-2 lens. Final images were arranged into plates using Adobe Photoshop. Measurements of specimens were taken with an ocular micrometer on an Olympus SZX12 stereomicroscope and are given for the holotype, with those of paratypes in parentheses.

Systematics

Genus ***Caenaugochlora*** Michener, 1954

Subgenus ***Ctenaugochlora*** Eickwort, 1969

Caenaugochlora (***Ctenaugochlora***) Eickwort, 1969: 435.
Type species. – ***Neocorynura perpectinata*** Michener, 1954, by original designation.
Engel, 2000: 36;
Michener, 2000: 389;
Michener, 2007: 405.

Diagnosis

Female. – Compound eyes with minute setae or glabrous. Pronotal lateral angle not produced, obtuse; subpleural signum tuberculate, sometimes strongly so, and pointed. Mesofemoral brush dense, black; metabasitibial plate bordered posteriorly, anterior margin obsolete; inner metatibial spur densely pectinate, with more than 10 long branches (Fig. 1-4). Basal area of propodeum with strong striae radiating from basal margin to apex or near to apex.

Male. – Apical margin of sternum IV with V-shaped concavity medioapically, with dense triangular setal patch but not raised on tubercles; apical margin of sternum VIII unmodified. Mesal margin of volsella rounded.

Remarks. – Note that some authors consider the subgenera to represent distinct genera in their own right (*e.g*., Gonçalves et al., 2022), and as each is monophyletic and collectively form a clade it is a matter of semantics whether one considers them to be genera or subgenera. I follow historical precedence in considering *Ctenaugochlora* as a subgenus of *Caenaugochlora* (Eickwort, 1969; Engel, 2000; Michener, 2007).

The subgenus is here considered to include the following species, with distributions by country and province (the latter in parentheses):

C. (*C*.) *algeri* Engel, 1995
Costa Rica (Heredia), Panamá (Panamá)

C. (*C*.) *beethoveni* Engel, 1995
Costa Rica (Cartago, Heredia, Puntarenas)

C. (*C*.) *donnae* Engel, 1995
Costa Rica (San José)

C. (*C*.) *formosa* **n**. **sp**.
Costa Rica (Alajuela, Cartago, Guanacaste)

C. (*C*.) *incompleta* **n**. **sp**.
Costa Rica (Alajuela)

C. (*C*.) *isaaci* Engel, 2019
Ecuador (Santo Domingo)

C. (*C*.) *mediopolita* **n**. **sp**.
Costa Rica (Alajuela)

C. (*C*.) *perpectinata* (Michener, 1954)
Costa Rica (Heredia), Panamá (Panamá, Panamá Oeste)

C. (*C*.) *perviridis* Engel & Gonçalves, 2010
Costa Rica (Alajuela, Heredia, San José)

C. (*C*.) *raritas* **n**. **sp**.
Costa Rica (Guanacaste)

Caenaugochlora (***Ctenaugochlora***) ***donnae*** Engel, 1995
(Fig. 5-8)

Caenaugochlora (***Ctenaugochlora***) ***donnae*** Engel, 1995a: 283. Holotype ♀ (LACM), *visum*.

Holotype. – ♀, C.Rica: San José Prov., Pan-Am Hwy, 14 rd mi N San Isidro de General, ca. 1600 m, 20-23.vi.1974, W.A. Harding & J.P. Donahue (LACM).

Diagnosis. – This is the only brilliant metallic blue species of the subgenus (Fig. 5-8). Additionally, it is one of several species in which the mesal clypeo-genal sulcus is nearly as long as the frontoclypeal sulcus, thereby elongating the head (Fig. 6). The mesoscutellum is bigibbous. The striae of the basal area of the propodeum are strong and radiating from the base to the rounded apical margin (Fig. 7). The male of this species remains unknown. The male reported by Engel (2000: 82) was based on a misidentification (Engel, in press).

Caenaugochlora (***Ctenaugochlora***) ***perviridis*** Engel & Gonçalves, 2010
(Fig. 1, 9-11)

Caenaugochlora (***Ctenaugochlora***) ***perviridis*** Engel & Gonçalves, 2010: 102. Holotype ♀ (SEMC), *visum*.

Holotype. – ♀, Costa Rica, Cartago Prov., Refugio Nac. de Fauna Silvestre, Tapanti, 1 km E. Station, 1410 m, 9°45.129'N, 83°46.936'W, 1 November 2001, R. Brooks, ex. on white flowers (SEMC).

Additional material examined

4 ♀, Costa Rica, Prov. Alajuela, Guatuso, P.N. [Parque Nacional] Volcán Tenorio, Falda Norte [North slope] Volcán Tenorio I., 1600 m, 9 Jun–24 Jul 2006, J. Azofeifa, Tp. [Trap] Malaise (INBIO);

Fig. **1**-**4**. Inner metatibial spurs of females of *Ctenaugochlora* Eickwort.

1. *Caenaugochlora* (*Ctenaugochlora*) *formosa* **n**. **sp**. **2**. *C*. (*C*.) *incompleta* **n**. **sp**. **3**. *C*. (*C*.) *beethoveni* Engel. **4**. *C*. (*C*.) *perpectinata* (Michener).

Key to Species of *Ctenaugochlora*

The following key, based solely on females, is revised and expanded from those of Engel (1995a, 2019) and Engel & Gonçalves (2010). Males are only known for ***C. perpectinata*** and ***C. formosa***.

1. Head and mesosoma brilliant metallic in color **2**

— Head and mesosoma mainly black (sometimes with weak metallic highlights) **4**

2(**1**). Head and mesosoma metallic green or dark metallic copper, not brilliant blue; metasoma metallic green or reddish copper; subpleural signum weakly or not tuberculate; mesoscutellum comparatively flat, not bigibbous **3**

— Head and mesosoma brilliant metallic blue with strong metallic purple and blue-green highlights; metasoma dark reddish brown with strong metallic blue to purplish blue highlights; subpleural signum strongly tuberculate; mesoscutellum bigibbous [Costa Rica] . . . . . ***C. donnae*** Engel, 1995

3(**2**). Head and mesosoma dark metallic copper, with purplish, gold, green, and blue highlights; metasoma metallic reddish copper, with golden and green highlights; border between lateral and posterior surfaces of propodeum thinly lamellate; head slightly wider than long; inner metatibial spur with 11–12 branches [Ecuador] . . . . . ***C. isaaci*** Engel, 2019

— Head and mesosoma metallic green; metasoma brilliant metallic green, with golden highlights; border between lateral and posterior surfaces of propodeum rounded angulate; head slightly longer than wide; inner metatibial spur with 18 branches [Costa Rica] . . . . . ***C. perviridis*** Engel & Gonçalves, 2010

4(**1**). Flagellum orange to light orangish brown ventrally **5**

— Flagellum brown to dark brown **7**

5(**4**). Metasoma brilliant metallic gold with green-copper highlights to copper-red with green highlights **6**

— Metasoma dark brown [Costa Rica] . . . . . ***C. raritas* n. sp.**

6(**5**). Basal area of propodeum with striae disappearing near midlength, then imbricate, apical margin rounded; mesal clypeo-genal sulcus 0.65× length of frontoclypeal sulcus; forewing 4Rs longer than 3Rs and 2rs-m nearly straight [Costa Rica] . . . . . ***C. incompleta* n. sp.**

— Basal area propodeum with striae extending to apical margin, apical margin rimmed; mesal clypeo-genal sulcus 0.40× length of frontoclypeal sulcus; forewing 4Rs shorter than 3Rs and 2rs-m arched [Costa Rica, Panamá] . . . . . ***C. algeri*** Engel, 1995

7(**4**). Basal area of propodeum with striae radiating from basal margin, sometimes incomplete but never transverse medially; forewing membrane uniformly colored, clear to lightly infumate throughout **8**

— Basal area of propodeum with striae radiating from basal margin except medially radiating oblique from midline and with some transverse striae medioapically; forewing membrane bicolored, anteriorly infumate, with remainder clear to faintly infumate [Costa Rica, Panamá] . . . . . ***C. perpectinata*** (Michener, 1954)

8(**7**). Basal area of propodeum with striae extending to apical margin, length relative to mesoscutellum variable (as long as to longer than mesoscutellum) **9**

— Basal area of propodeum with striae effaced medioapically, length of basal area as long as medial length of mesoscutellum [Costa Rica] . . . . . ***C. mediopolita* n. sp.**

9(**8**). Mesosoma dark brown to black without metallic highlights; basal area of propodeum as long as medial length of mesoscutellum; mesepisternum striate anteriorly then largely finely imbricate to coriaceous; head about as long as wide, length 1.00–1.03× width [Costa Rica] . . . . . ***C. beethoveni*** Engel, 1995

— Mesosoma dark brown to black with prominent metallic green to blue-green highlights laterally; basal area of propodeum longer than medial length of mesoscutellum; mesepisternum rugulose-punctate anterodorsally then coarsely imbricate; head narrower, length 1.07× width [Costa Rica] . . . . . ***C. formosa* n. sp.**

1 ♀, Costa Rica, Prov. Alajuela, Guatuso, P.N. [Parque Nacional] Volcán Tenorio, Falda Norte [North slope] Volcán Tenorio I., 1600 m, 24 Jul–17 Ago 2006, J. Azofeifa, Tp. [Trap] Malaise (INBIO);

1 ♀, Costa Rica, Prov. Alajuela, Guatuso, P.N. [Parque Nacional] Volcán Tenorio, Falda Norte [North slope] Volcán Tenorio I., 1600 m, 30 May–9 Jul 2006, J. Azofeifa, Tp. [Trap] Malaise (INBIO);

1 ♀, Costa Rica, Prov. Alajuela, P.N. [Parque Nacional] Volcán Tenorio, Falda Norte [North slope] V. [Volcán] Tenorio I., Los Quemados, 1200-1300 m, 18 Sep–22 Oct 2009, J.A. Azofeifa, Tp. [Trap] Malaise (INBIO);

1 ♀, Costa Rica, Prov. Alajuela, Guatuso, Cote Cabanga, Finca de José Martínez, 478 m, 14 Jun–14 Jul 2010, J.A. Azofeifa, Tp. [Trap] Malaise (INBIO); 1♀, Costa Rica, Prov. Heredia, 16 km SSE La Virgen, 10°16'N, 84°05'W, 1050–1150 m, INBio-ALAS, 9-iii-2001 (INBIO);

2 ♀, Costa Rica, Prov. San José, Moravia, Zurqui de Moravia, 1600 m, 22 Jul–8 Ago 2010, W. Porras, Tp. [Trap] Malaise (INBIO).

Diagnosis. – This species, like the preceding one, is unique in coloration for the subgenus. The body is entirely brilliant metallic green (Fig. 9-11), sometimes with brassy highlights, and with brown legs variably shading to orange or orangish brown on the more apical podites (Fig. 9). The mesal clypeo-genal sulcus is about 0.75× as long as the frontoclypeal sulcus (Fig. 10), and the basal area of the propodeum is about as long as the mesoscutellum, with radiating striae that reach the apical margin, which itself is rounded (Fig. 11). The male of this species remains unknown.

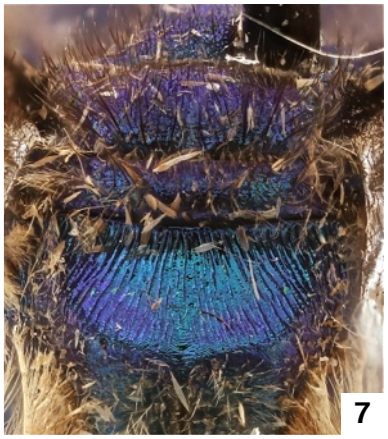

Fig. **5**-**7**. ***Caenaugochlora*** (***Ctenaugochlora***) ***donnae*** Engel, holotype ♀. **5**. Lateral habitus. **6**. Facial view. **7**. Mesoscutellum, metanotum, and basal area of propodeum.

Fig. **8**. Dorsal habitus of ***Caenaugochlora*** (***Ctenaugochlora***) ***donnae*** Engel, holotype ♀.

Fig. **9**-**11**. ***Caenaugochlora*** (***Ctenaugochlora***) ***perviridis*** Engel & Gonçalves, ♀. **9**. Lateral habitus. **10**. Facial view. **11**. Mesoscutellum, metanotum, and basal area of propodeum.

Caenaugochlora (***Ctenaugochlora***) ***isaaci*** Engel, 2019
(Fig. 12-15)

Caenaugochlora (***Ctenaugochlora***) ***isaaci*** Engel, 2019: 188. Holotype ♀ (FSCA), *visum*.

Holotype, ♀, Ecuador, Tinalandia Nature Res. [Reserve], nr. Quito, 10 to 17-vii-1980 [17 July 1980], malaise, H.V. Weems (FSCA).

Additional material examined

1 ♀ (paratype), Ecuador, Tinalandia Nature Res., nr. Quito, 10 to 17-vii-1980 [17 July 1980], malaise, H.V. Weems (FSCA).

Diagnosis. – This is another species with a unique coloration, the integument of the head and mesosoma being largely dark brown to black with prominent metallic brassy or purplish highlights (Fig. 12-14), especially on the propodeum (Fig. 15), while the metasoma is metallic reddish copper with yellow and greenish highlights laterally (Fig. 12). The head is slightly wider than long, with the mesal clypeo-genal sulcus short, about 0.25× as long as the frontoclypeal sulcus (Fig. 14), 11-12 branches on the inner metatibial spur, flat mesoscutellum (not bigibbous) (Fig. 15), and noticeably lamellate lateral borders to the posterior propodeal surface, such lamellae extending along the entire length (Fig. 15). The male of this species remains unknown.

Caenaugochlora (***Ctenaugochlora***) ***algeri*** Engel, 1995
(Fig. 16-20)

Caenaugochlora (***Ctenaugochlora***) ***algeri*** Engel, 1995a: 285. Holotype ♀ (CUIC), *visum*.

Holotype. – ♀, Panama: Panama Prov., Chepo, 6 km NE C. rd. 24 Nov 1982, D. Roubik, No. 57 [Cornell type no. 6939] (CUIC).

Fig. 12-15. ***Caenaugochlora*** (***Ctenaugochlora***) ***isaaci*** Engel, holotype ♀ (reproduced from Engel, 2019). **12**. Lateral habitus. **13**. Dorsal habitus. **14**. Facial view of paratype. **15**. Mesoscutellum, metanotum, and basal area of propodeum of paratype.

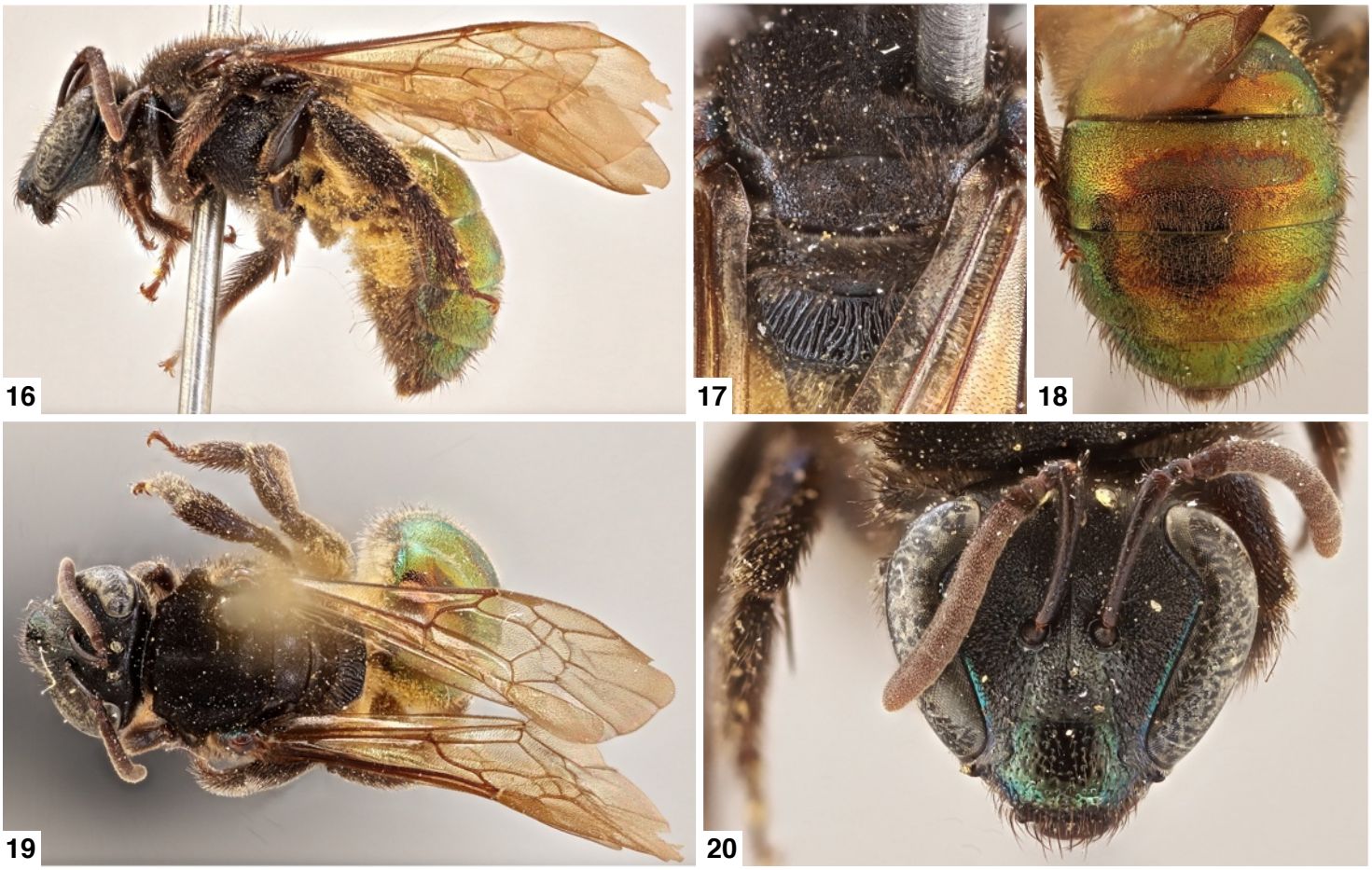

Fig. **16**-**20**. ***Caenaugochlora*** (***Ctenaugochlora***) ***algeri*** Engel, holotype ♀. **16**. Lateral habitus. **17**. Mesoscutellum, metanotum, and basal area of propodeum. **18**. Dorsal view of metasoma. **19**. Dorsal habitus. **20**. Facial view.

Additional material examined

2 ♀, Costa Rica: La Virgen de Serapiquí [sic: Sarapiquí, Heredia Prov.], 1997, Finca La Tirimbiria (SEMC).

Diagnosis. – This is an interesting species as it is the only species of the subgenus in which the apical border of the basal area of the propodeum is rimmed, the striae terminating into this sharp ridge (Fig. 17). It is also the only species in which the anterior border of the third submarginal cell is shorter than that of the second submarginal cell, with 2rs-m typically distinctly arched. The metasoma is largely metallic green-gold with strong metallic coppery and reddish highlights (Fig. 16, 18, 19). It is worth noting that the metallic reddish color of the metasoma is more extensive and intense in the two females from Costa Rica relative to that of the holotype. The species is superficially similar to *C. incompleta* (*infra*) but can be differentiated by those characters summarized under the account of that species. The male of this species remains unknown.

Caenaugochlora (***Ctenaugochlora***) ***incompleta*** **n. sp.**

(Fig. 21-23)

ZooBank: https://zoobank.org/8B5A22B1-413D-484A-A42B-4CC328EC3E92

Holotype, ♀, Costa Rica, Prov. Alajuela, San Ramón, Est. Biol. Villa Blanca, 1115 m, 29 Oct–1 Nov 2008, R. Rojas, Tp. Luz Mercurio [mercury vapor lamp] (INBIO).

Diagnosis. – At first glance this species superficially resembles *C. algeri* owing to the brilliant metallic metasoma coupled with a black head and mesosoma (Fig. 21). However, upon closer inspection it differs from *C. algeri* quite notably, particularly in the following: the head is more narrow and elongate (Fig. 22), with the mesal clypeo-genal sulcus 0.65× the length of the frontoclypeal sulcus and the medial length of the postclypeus slightly less than that of the anteclypeus (versus the mesal clypeo-genal sulcus 0.40× the length of the frontoclypeal sulcus and the medial length of the postclypeus about one-third the medial length of the clypeus in *C. algeri*). Moreover, the basal area of the propodeum has striae radiating from the basal margin but disappearing near midlength into otherwise imbricate integument and the posterior margin rounded (Fig. 23) (striae strong and reaching apical margin, which itself is rimmed in *C. algeri*). Lastly, the new species lacks metallic highlights on the face (Fig. 22), while there are often some small and weak metallic highlights in *C. algeri*, particularly in the paraocular area and sometimes on the clypeus (Fig. 20). The male of this species is unknown.

Description of the holotype

Total body length 9.26 mm; forewing length 7.89 mm. Head slightly longer than wide, length 2.43 mm, width 2.37 mm; postclypeus only slightly shorter than anteclypeus; mesal clypeo-genal sulcus 0.65× length of frontoclypeal sulcus; upper interorbital distance 1.17 mm, lower interorbital distance 1.07 mm; frontal line carinate between antennal toruli to distance about an ocellar diameter to median ocellus, weakly impressed line from that point onward; preoccipital carina strongly carinate. Mesoscutum with median and parapsidal lines strongly impressed; intertegular distance 1.97 mm; subpleural signum tuberculate; mesoscutellum comparatively flat, not depressed medially or bigibbous; lateral and posterior surfaces of propodeum separated by a thin lamella tapering and disappearing dorsally. Forewing with basal vein distad 1cu-a by about 5× vein width; 1rs-m basad 1m-cu by about crossvein width; 2rs-m distad 2m-cu by about 4× crossvein width, 2rs-m nearly straight; first submarginal cell slightly longer than combined lengths of second and third submarginal cells as measured along posterior borders; second submarginal cell almost parallel-sided, 3Rs nearly as long as 2M; 4Rs slightly longer than 3Rs, about 0.45× as long as 3M; distal hamuli arranged 3-1-3. Metabasitibial plate narrow,

anterior border obsolescent, posterior border weakly defined but not rimmed; inner metatibial spur with 16 branches, not including apical portion of rachis (Fig. 2).

Clypeus with coarse, shallow, punctures separated by a puncture width or less, punctures denser and more elongate apically, integument between punctures strongly imbricate; supraclypeal area with smaller, fainter, shallow punctures scattered amid strongly imbricate integument; face below level of antennal toruli sculptured as on supraclypeal area, blending to small contiguous punctures on frons, otherwise imbricate; punctures in ocellocular area minute and nearly contiguous, integument between shining; vertex and gena sculptured as on supraclypeal area, gena ventrally and postgena becoming weakly striate and imbricate. Mesoscutum and mesoscutellum with small contiguous punctures, slightly weaker and sparser anteriorly on mesoscutum, integument strongly imbricate; metanotum colliculate, with punctures at setal bases; mesepisternum coarsely and irregularly rugulose-punctate, striate on hypoepimeral area, punctures larger ventrally; metepisternum with transverse striae on upper half, striae blending to finely imbricate and minutely punctate ventrally; lateral and posterior surfaces of propodeum finely and faintly imbricate, striate on upper boundary with basal area of propodeum, minute punctures at setal bases; basal area of propodeum with strong radiating striae that disappear medially, integument becoming imbricate before attaining rounded apical border, integument between striae smooth and shining. Metasomal terga with minute punctures separated by a puncture width or less, integument between punctures smooth to faintly and finely imbricate except punctures more widely scattered and integument shining and smooth on anterior-facing surface of tergum I and gradually sparser on progressively more apical terga from tergum III onward; metasomal sterna with coarse, shallow, punctures separated by a puncture width or less, integument otherwise imbricate.

Head and mesosoma black, without metallic highlights except antennal flagellum orangish ventrally and faint metallic blue highlights on pronotum and upper lateral surface of propodeum; legs dark brown to black; metasomal terga metallic golden green with additional strong golden highlights on terga II onward, sterna dark brown with weak metallic highlights in apical halves.

Pubescence generally scattered, fine, dark fuscous except minute erect paler setae intermixed on metanotum; lateral and posterior surfaces of propodeum with scattered, minute, appressed setae, lateral surface with canistra (*sensu* Engel, 2001) composed of elongate, yellow setae; metafemoral scopa similar in color to canistra; metasoma with scattered fuscous setae and bristles, those of apical terga longest, intermixed with minute setae; scopa-like, yellowish setae on lateral ventrally oriented portions of terga I and II and abundantly and elongate on sterna I-III, such setae slightly shorter and progressively dark fuscous on remaining sterna.

Male. – Unknown.

Etymology. – The specific epithet is the Latin adjective *incomplētus*, meaning, "incomplete", in reference to the partial coverage of striae on the basal area of the propodeum relative to that in *C. algeri*.

Caenaugochlora (*Ctenaugochlora*) *perpectinata* (Michener, 1954)

(Fig. 2, 24-26)

Neocorynura perpectinata Michener, 1954: 83. Holotype ♀ (AMNH), *visum*.

Caenaugochlora (***Ctenaugochlora***) ***perpectinata*** (Michener); Eickwort, 1969: 435 [♂ terminalia figured: 471, 480, 495].

Holotype, ♀, [Panamá], Barro Colo. Is., C.Z. [Canal Zone], i-8-1945, C.D. Michener (AMNH).

Additional material examined

2 ♀ (paratypes), [Panamá], Barro Colo. Is., C.Z. [Canal Zone], i-8-1945, C.D. Michener (AMNH);

2 ♀, Costa Rica, Heredia, 16 km SSE La Virgen, 10°16'N, 84°05'W, 1050-1150 m, INBio-ALAS, 21-ii to 9-iii-2001 (INBIO);

4 ♀, **1** ♂, Costa Rica: Cartago, P.N. Tapanti, 1150 m, 9°45'41"N, 83°47'5"E [mislabeled, *recte* W], 18 July 2000, J. Ashe, R. Brooks, Z. Falin, ex: flowering tree (SEMC);

3 ♂, Panamá, Panamá Prov. [Panamí Oeste], 8 km NW Capira, Cerro Campana, 1000 m, on *Clethra lanata* [M. Martens et Galeotti (Ericales: Clethraceae)], 7 May 1981, R.W. Brooks (SEMC).

Diagnosis. – The female of this species was described in detail by Michener (1954) and the male by Eickwort (1969). The species is noteworthy for the bicolored forewing membrane, which is infumate anteriorly and clear to faintly infumate posteriorly and the unique pattern of striation on the basal area of the propodeum. The striae of the basal area radiate from the basal margin except medially they radiate oblique from midline and with some transverse striae medioapically (Fig. 26). This pattern is not observed in any other species of the subgenus.

Caenaugochlora (*Ctenaugochlora*) *raritas* **n. sp.**

(Fig. 27-29)

ZooBank: https://zoobank.org/CF736983-1875-49E3-8B20-5D5A10C7080A

Holotype, ♀, Costa Rica, Prov. Guanacaste, Macizo Miravallez, Estac. Cabro Muco, 1100 m, 20 Mar 2003, R. Hernández, Libre (INBIO).

Diagnosis. – This is a wholly dark species (Fig. 27), with flagellomeres that are orangish ventrally (Fig. 27, 28). In many respects it is superficially similar to *C. algeri* and *C. incompleta* except in the lack of metallic coloration relative to the former and the more complete propodeal striae (Fig. 29) compared to the latter. In addition, unlike *C. algeri* the third submarginal cell is longer than second submarginal cell along their anterior borders and the apical margin of the basal area of the propodeum is rounded.

Fig. 21-23. ***Caenaugochlora*** (***Ctenaugochlora***) ***incompleta*** **n. sp.**, holotype ♀. **21**. Lateral habitus. **22**. Facial view. **23**. Mesoscutellum, metanotum, and basal area of propodeum.

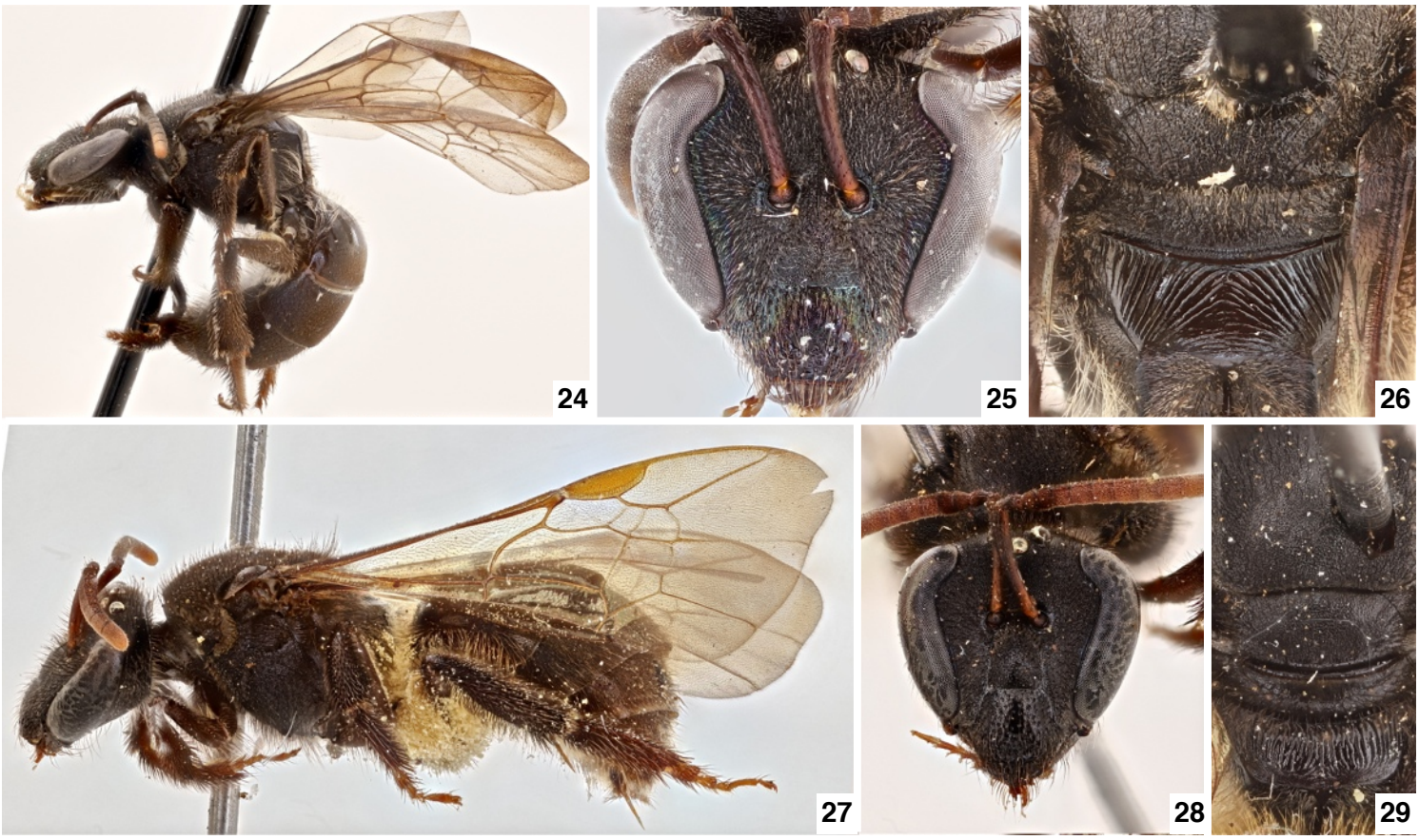

Fig. **24-26**. ***Caenaugochlora*** (***Ctenaugochlora***) ***perpectinata*** (Michener), ♀. **24**. Lateral habitus. **25**. Facial view. **26**. Mesoscutellum, metanotum, and basal area of propodeum.

Fig. **27-29**. ***Caenaugochlora*** (***Ctenaugochlora***) ***raritas*** **n**. **sp**., holotype ♀. **27**. Lateral habitus. **28**. Facial view. **29**. Mesoscutum, mesoscutellum, metanotum, and basal area of propodeum.

Description of the holotype

Total body length 8.95 mm; forewing length 7.79 mm. Head slightly longer than wide, length 2.43 mm, width 2.40 mm; postclypeus only slightly shorter than anteclypeus; mesal clypeo-genal sulcus 0.7× length of frontoclypeal sulcus; upper interorbital distance 1.17 mm, lower interorbital distance 1.03 mm; frontal line carinate between antennal toruli to half distance to median ocellus, weakly impressed line from that point onward; preoccipital carina carinate. Mesoscutum with median and parapsidal lines strongly impressed; intertegular distance 2.07 mm; subpleural signum tuberculate; mesoscutellum comparatively flat, not depressed medially or bigibbous; lateral and posterior surfaces of propodeum separated by a thin lamella tapering and disappearing dorsally. Forewing with basal vein distad 1cu-a by about 3× vein width; 1rs-m confluent with 1m-cu; 2rs-m distad 2m-cu by about 4× crossvein width, 2rs-m weakly curved; first submarginal cell about as long as combined lengths of second and third submarginal cells as measured along posterior borders; second submarginal cell almost parallel-sided, 3Rs slightly shorter than 2M; 4Rs slightly longer than 3Rs, about 0.5× as long as 3M; distal hamuli arranged 3-1-3. Metabasitibial plate narrow, anterior border obsolescent, posterior border weakly defined; inner metatibial spur with 17 branches, not including apical portion of rachis.

Clypeus with coarse, shallow punctures separated by a puncture width or less, punctures slightly denser and elongate apically, integument between punctures imbricate; supraclypeal area with smaller, fainter, shallow punctures scattered amid strongly imbricate integument; face below level of antennal toruli sculptured as on supraclypeal area, blending to small contiguous punctures on frons, otherwise imbricate; punctures in ocellocular area minute and nearly contiguous, integument between shining; vertex and gena sculptured as on supraclypeal area, gena ventrally and postgena becoming weakly striate and imbricate. Mesoscutum and mesoscutellum with small contiguous punctures, slightly weaker and sparser anteriorly on mesoscutum, integument strongly imbricate; metanotum colliculate, with punctures at setal bases; mesepisternum coarsely and irregularly rugulose-punctate, striate on hypoepimeral area, punctures larger ventrally; metepisternum with transverse striae on upper half, striae blending to finely imbricate and minutely punctate ventrally; lateral and posterior surfaces of propodeum finely and faintly imbricate, minute punctures at setal bases; basal area of propodeum with strong striae extending from base to rounded apical margin except those of lateral thirds ending subapically with thin imbricate margin, integument between striae smooth and shining. Metasomal terga with minute punctures separated by a puncture width or less although sparse on tergum I and progressively sparser on terga toward apical margins, integument between punctures smooth to faintly and finely imbricate except on tergum I integument more shining and smooth on anterior-facing surface; punctures gradually sparser on progressively more apical terga from tergum III onward; metasomal sterna with coarse, shallow, punctures separated by a puncture width or less, integument otherwise imbricate.

Head, mesosoma, and metasoma dark brown to black, without metallic highlights except antennal flagellum orangish brown ventrally and with areas of orangish brown at base and apex of scape.

Pubescence generally scattered, fine, dark fuscous except minute erect paler setae intermixed on metanotum; lateral and posterior surfaces of propodeum with scattered, minute, appressed setae, lateral surface with canistra of elongate, yellow setae; metafemoral scopa similar in color to canistra; metasoma with scattered light fuscous to pale setae and bristles, those of apical terga longest, intermixed with minute setae; scopa-like, yellowish setae on lateral ventrally oriented portions of terga I and II and abundantly and elongate on sterna I-III, such setae slightly shorter and progressively fuscous with lighter apices on remaining sterna.

Male. – Unknown.

Etymology. – The specific epithet is the Latin noun *rāritās*, meaning, “a thing that is rare”.

***Caenaugochlora* (*Ctenaugochlora*) *formosa* n. sp.**

(Fig. 1, 30-43)

ZooBank: https://zoobank.org/BC43A89B-8094-4792-8E72-B5C8861E9A33

Holotype, ♀, Costa Rica, Prov. Alajuela, Guatuso, P.N. [Parque Nacional] Volcán Tenorio, Punto 4, Cerro Montezuma, 1510 m, 29 Jun–24 Jul 2011, J.A. Azofeifa, Tp. [Trap] Malaise (INBIO).

Paratypes

1 ♀, **2** ♂, Costa Rica, Prov. Alajuela, Guatuso, P.N. [Parque Nacional] Volcán Tenorio, Falda Norte [North slope] Volcán Tenorio I., 1600 m, 9 Jun–24 Jul 2005, J. Azofeifa, Tp. [Trap] Malaise (INBIO);

2 ♀, Costa Rica, Prov. Alajuela, Guatuso, P.N. [Parque Nacional] Volcán Tenorio, Falda Norte [North slope] Volcán Tenorio I., 1600 m, 24 Jul–17 Ago 2005, J. Azofeifa, Tp. [Trap] Malaise (INBIO);

1 ♀, Costa Rica, Prov. Alajuela, Guatuso, P.N. [Parque Nacional] Volcán Tenorio, Punto 4, Cerro Montezuma, 1510 m, 25 Ago–25 Oct 2011, J.A. Azofeifa, Tp. [Trap] Malaise (INBIO);

1 ♂, Costa Rica, Prov. Cartago, Turrialba, P.N. [Parque Nacional] Barbilla, Send. Barthon, 1617 m, 11 al 26 Jun 2001, F. Umana, Manuel (INBIO);

1 ♀, Costa Rica, Prov. Guanacaste, P.N. [Parque Nacional] Volcán Tenorio, Volcán Tenorio, 1650 m, 5 Ago–5 Oct 2003, J. Azofeifa, Tp. [Trap] Malaise (INBIO).

Diagnosis. – This species is superficially similar to *C. beethoveni* owing to the overall dark coloration but can be rather easily distinguished by the presence of metallic green to blue-green highlights, weak on the face, but quite prominent on the mesosoma laterally (Fig. 30). In addition, the mesepisternum is rugulose-punctate anterodorsally then coarsely imbricate over much of the surface (rather than finely imbricate to coriaceous in *C. beethoveni*).

Description

Female

Total body length 9.58 mm (8.48-9.58 mm); forewing length 7.89 mm (7.16-8.00) mm. Head longer than wide (Fig. 31), length 2.43 mm (2.30-2.50 mm), width 2.27 mm (2.10-2.33 mm); postclypeus about as long as anteclypeus; mesal clypeo-genal sulcus 0.55-0.65× length of frontoclypeal sulcus; upper interorbital distance 1.07 mm (1.00-1.10 mm), lower interorbital distance 1.00 mm (0.93-1.00 mm); frontal line carinate between antennal toruli to distance about half distance to median ocellus, weakly impressed line from that point onward; preoccipital carina strongly carinate. Mesoscutum with median and parapsidal lines strongly impressed; intertegular distance 1.93 mm (1.67-1.93 mm); subpleural signum tuberculate; mesoscutellum comparatively flat, not depressed medially or bigibbous; lateral and posterior surfaces of propodeum separated by a thin lamella tapering and disappearing dorsally. Forewing with basal vein distad 1cu-a by about 3.5-5× vein width; 1rs-m confluent to basad 1m-cu by about 2× crossvein width; 2rs-m distad 2m-cu by about 4-5× crossvein width, 2rs-m weakly curved; first submarginal cell slightly shorter than combined lengths of second and third submarginal cells as measured along posterior borders; second submarginal cell narrowed anteriorly, 3Rs shorter than 2M; 4Rs slightly longer than 3Rs, about 0.4× as long as 3M; distal hamuli arranged 3-1-3. Metabasitibial plate narrow, anterior border obsolescent, posterior border weakly defined but not rimmed; inner metatibial spur with 16-18 branches, not including apical portion of rachis.

Clypeus with coarse, shallow, punctures separated by a puncture width or less, punctures denser apically, integument between punctures strongly imbricate; supraclypeal area with smaller, fainter, shallow, scattered punctures, integument between punctures strongly imbricate; face below level of antennal toruli as on supraclypeal area, blending to small contiguous punctures on frons, otherwise imbricate; punctures in ocellocular area as on frons; vertex and gena sculptured as on supraclypeal area, gena ventrally and postgena weakly striate and imbricate. Mesoscutum and mesoscutellum with small contiguous punctures, slightly weaker on mesoscutum and thus appearing more strongly imbricate; metanotum as on mesoscutellum;

Fig. 30-35. ***Caenaugochlora* (*Ctenaugochlora*) *formosa* n. sp. 30-32**. Paratype ♀. **30**. Lateral habitus. **31**. Facial view. **32**. Mesoscutellum, metanotum, and basal area of propodeum. **33-35**. Paratype ♂. **33**. Lateral habitus. **34**. Facial view. **35**. Mesoscutellum, metanotum, and basal area of propodeum.

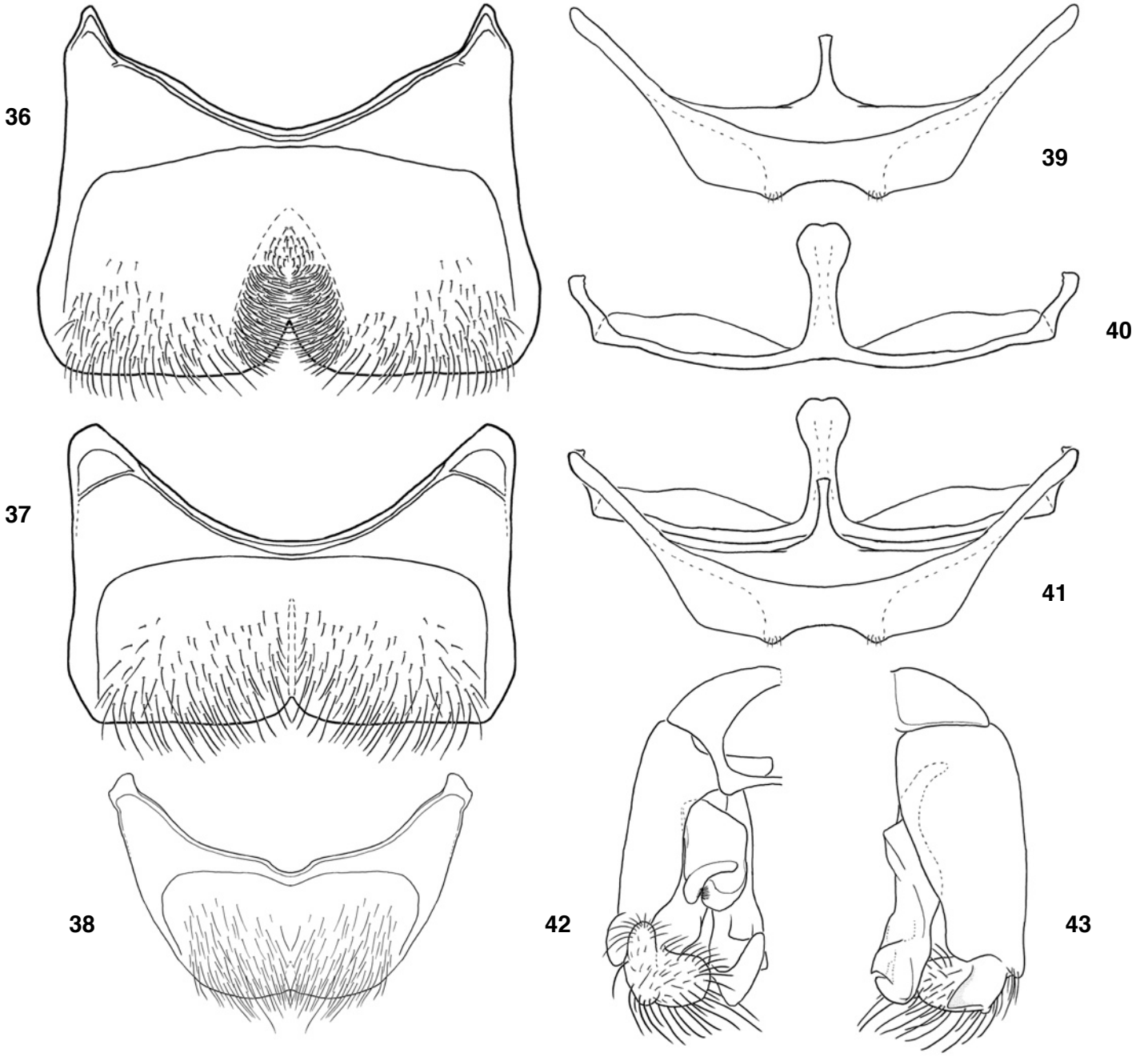

Fig. **36**-**43**. ***Caenaugochlora*** (***Ctenaugochlora***) ***formosa*** **n**. **sp**., ♂ terminalia. **36**. Sternum IV. **37**. Sternum V. **38**. Sternum VI. **39**. Sternum VII. **40**. Sternum VIII. **41**. Sterna VII+VIII in natural state of fusion. **42**. Genital capsule, ventral view. **43**. Genital capsule, dorsal view.

preëpisternum coarsely and irregularly rugulose-punctate, mesepisternum as on preëpisternum dorsally blending to coarsely imbricate on much of surface with scattered shallow punctures, striate on hypoepimeral area; metepisternum with transverse striae on upper half, striae blending to finely imbricate and minutely punctate ventrally; lateral and posterior surfaces of propodeum finely and faintly imbricate, minute punctures at setal bases; basal area of propodeum with strong radiating striae that extend nearly to rounded apical margin (Fig. 32), integument becoming finely imbricate near apical border, integument between striae finely imbricate. Metasomal terga finely imbricate with scattered minute punctures except proximal half tergum I impunctate and shining; metasomal sterna with coarse, shallow, punctures separated by a puncture width or less except sparser in proximal halves, integument otherwise imbricate.

Head and mesosoma black, with metallic green to blue highlights in paraocular area, sometimes on clypeus, extensive metallic green to blue-green highlights on pronotum, pleura, and lateral surface of propodeum, sometimes similar but weaker highlights on posterior surface of propodeum; legs dark brown to black except lighter on tarsi and spurs yellowish brown to yellow; metasomal terga dark brown to black with similar but weaker metallic highlights as on mesosoma restricted to tergum I and laterally on terga II and III.

Pubescence generally scattered, fine, pale fuscous to off-white setae; lateral and posterior surfaces of propodeum with scattered, minute, appressed setae, lateral surface with canistra of elongate, off-white setae; metafemoral scopa of same color to canistra; metasoma with scattered pale fuscous setae and bristles, those of apical terga longest, intermixed with minute setae; scopa-like, off-white setae on lateral ventrally oriented portions of terga I and II and abundant and elongate on sterna I–III, such setae slightly shorter and more fuscous on remaining sterna.

Male

As described for the female except in usual sexual dimorphism (Fig. 33-35) and as follows: Total body length 9.05-9.37 mm; forewing length 7.58-7.89 mm. Head slightly longer than wide, length 2.33-23.7 mm, width 2.23-2.27 mm; mesal clypeo-genal sulcus 0.80× length of frontoclypeal sulcus; upper interorbital distance 1.07-1.10 mm, lower interorbital distance 0.70–0.77 mm; scape lighter in color basally than in female, with setae more abundant and longer than in female; intertegular distance 1.67-1.70 mm. Male terminalia as in figures 36-43.

Etymology. – The specific epithet is the Latin adjective *fōrmōsus*, meaning, "beautiful".

***Caenaugochlora* (*Ctenaugochlora*) *mediopolita* n. sp.**

(Fig. 44-46)

ZooBank: https://zoobank.org/F7505FD7-AD0F-46E7-A5F7-D9CBFCB0F4F2

Holotype, ♀, Costa Rica, Prov. Alajuela, Guatuso, P.N. [Parque Nacional] Volcán Tenorio, Falda Norte [North slope] Volcán Tenorio I., 1600 m, 9 Jun–24 Jul 2006, J. Azofeifa, Tp. [Trap] Malaise (INBIO).

Diagnosis. – The holotype of this species (Fig. 44) was at first glance interpreted as a small individual of the proceeding species but closer inspection shows noteworthy differences in coloration and sculpturing. Unlike *C. formosa*, *C. mediopolita* has the striae of the basal area of the propodeum interrupted medially (Fig. 46), extending to only midlength, and the integument between the striae smooth and shining (refer to diagnosis for *C. formosa*, *supra*). In addition, the mesal clypeo-genal sulcus 0.77× the length of the frontoclypeal sulcus (Fig. 45), while it is shorter (0.55-0.65×) in *C. formosa*.

Description of the holotype

Total body length 8.53 mm; forewing length 7.47 mm. Head slightly longer than wide, length 2.27 mm, width 2.13 mm; postclypeus as long as anteclypeus; mesal clypeo-genal sulcus 0.77× length of frontoclypeal sulcus; upper interorbital distance 1.07 mm, lower interorbital distance 0.97 mm; frontal line carinate between antennal toruli to half distance to median ocellus, weakly impressed line from that point onward; preoccipital carina strongly carinate. Mesoscutum with median and parapsidal lines strongly impressed; intertegular distance 1.67 mm; subpleural signum tuberculate; mesoscutellum comparatively flat, not depressed medially or bigibbous; lateral and posterior surfaces of propodeum separated by a thin lamella tapering and disappearing dorsally. Forewing with basal vein distad 1cu-a by about 2.5× vein width; 1rs-m confluent with 1m-cu; 2rs-m distad 2m-cu by about 5× crossvein width, 2rs-m weakly curved, nearly straight; first submarginal cell as long as combined lengths of second and third submarginal cells as measured along posterior borders; second submarginal cell narrowing anteriorly, 3Rs distinctly shorter than 2M; 4Rs noticeably longer than 3Rs, about 0.54× as long as 3M; distal hamuli arranged 3-1-3. Metabasitibial plate narrow, anterior border obsolescent, posterior border weakly defined but not rimmed; inner metatibial spur with 14-15 branches, not including apical portion of rachis.

Clypeus with coarse, shallow, punctures separated by a puncture width or less, integument between punctures strongly imbricate; supraclypeal area sculpted as on clypeus except shallow punctures smaller, weaker; face below level of antennal toruli sculptured as on supraclypeal area, blending to small contiguous punctures on frons, otherwise imbricate; punctures in ocellocular area as on upper frons; vertex sculptured as on supraclypeal area, upper gena lineolate, punctate, and imbricate, ventrally extending into weakly striate and imbricate postgena. Mesoscutum and mesoscutellum with small contiguous punctures, slightly weaker and sparser anteriorly on mesoscutum, integument strongly imbricate; metanotum as on mesoscutellum; preëpisternum coarsely and irregularly rugulose-punctate, mesepisternum coarsely imbricate with scattered small, shallow punctures, striate on anterior border of hypoepimeral area, remainder as on mesepisternum; metepisternum with transverse striae on upper quarter, striae blending to finely imbricate and minutely punctate ventrally; lateral and posterior surfaces of propodeum finely and faintly imbricate, striate on upper boundary with basal area of propodeum, minute punctures at setal bases; basal area of propodeum with strong radiating striae that disappear medially, medial striae extend only to about midlength, integument shining and faintly imbricate before attaining rounded apical border, integument between striae smooth and shining. Metasomal terga finely imbricate with scattered minute punctures except punctures more defined and denser on tergum I except proximal half impunctate and shining; metasomal sterna with coarse, shallow, punctures separated by a puncture width or less except sparser in proximal halves, integument otherwise imbricate.

Head and mesosoma black, with weak metallic green highlights on pronotum and lateral and posterior surfaces of propodeum; legs dark brown to black; metasoma dark brown.

Pubescence generally scattered, fine, pale fuscous to nearly off-white except minute erect paler setae intermixed on metanotum; lateral and posterior surfaces of propodeum with scattered, minute, appressed setae, lateral surface with canistra of elongate, off-white setae; metafemoral scopa similar in color to canistra; metasoma with scattered paleo fuscous to fuscous setae and fuscous bristles, those of apical terga longest, intermixed with minute paler setae; scopa-like, off-white setae on lateral ventrally oriented portions of terga I and II and abundantly and elongate on sterna I–III, such setae slightly shorter and progressively fuscous on remaining sterna.

Male. – Unknown.

Etymology. – The specific epithet is the Latin noun *medius*, meaning, "middle", and the adjective *polītus*, meaning, "polished".

Caenaugochlora* (*Ctenaugochlora*) *beethoveni Engel, 1995

(Fig. 3, 47-49)

Caenaugochlora* (*Ctenaugochlora*) *beethoveni Engel, 1995a: 281. Holotype ♀ (CUIC), *visum*.

Holotype, ♀, Costa Rica: Puntarenas Prov., Monteverde, 26 June 1981, S. Knapp, #0047 [Cornell type no. 6940] (CUIC).

Additional material examined

1 ♀, Costa Rica, Heredia, 16 km SSE La Virgen, 10°16'N, 84°05'W, 1050-1150 m, INBio-ALAS, 21-ii-2001 (INBIO);

4 ♀, Costa Rica, Heredia, 16 km SSE La Virgen, 10°16'N, 84°05'W, 1050-1150 m, INBio-ALAS, 21-ii to 9-iii-2001 (INBIO);

Fig. 44-46. ***Caenaugochlora* (*Ctenaugochlora*) *mediopolita* n. sp.**, holotype ♀. **44**. Lateral habitus. **45**. Facial view. **46**. Mesoscutellum, metanotum, and basal area of propodeum.

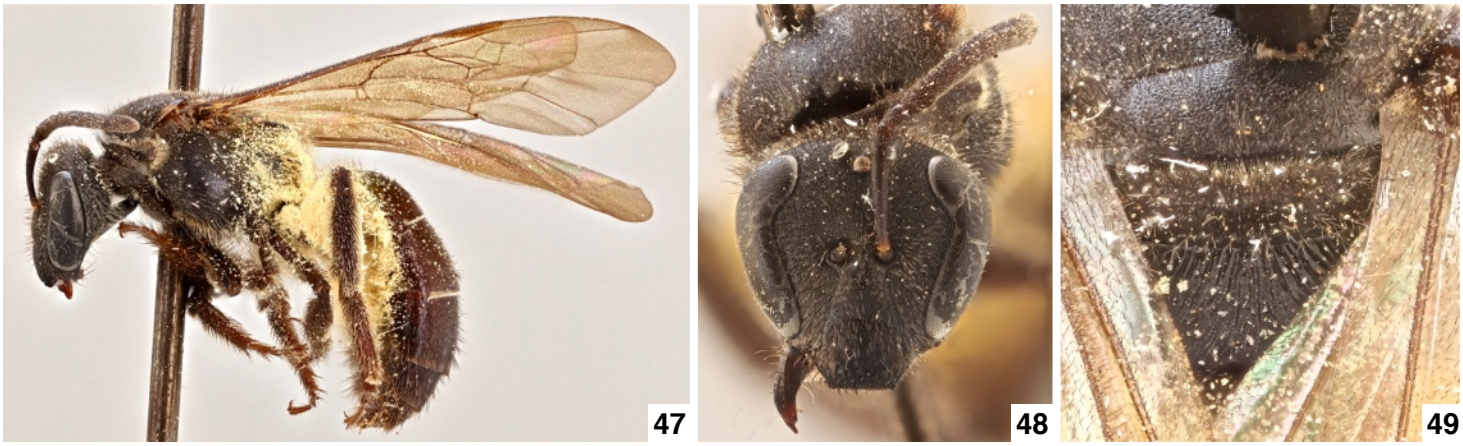

Fig. **47**-**49**. ***Caenaugochlora*** (***Ctenaugochlora***) ***beethoveni*** Engel, holotype ♀. **47**. Lateral habitus. **48**. Facial view. **49**. Mesoscutellum, metanotum, and basal area of propodeum.

1 ♀, Costa Rica, Heredia, 16 km SSE La Virgen, 10°16'N, 84°05'W, 1050-1150 m, INBio-ALAS, 9-iii-2001 (INBIO);

2 ♀, Costa Rica, Heredia, 16 km SSE La Virgen, 10°16'N, 84°05'W, 1050-1150 m, INBio-ALAS, 9–21-iii-2001 (INBIO);

1 ♀, Costa Rica, Heredia, 16 km SSE La Virgen, 10°16'N, 84°05'W, 1050-1150 m, INBio-ALAS, 21-iii-2001 (INBIO);

1 ♀, Costa Rica, Heredia, 16 km SSE La Virgen, 10°16'N, 84°05'W, 1050-1150 m, INBio-ALAS, 21-iii–9-iv-2001 (INBIO);

1 ♀, Costa Rica, Heredia, 16 km SSE La Virgen, 10°16'N, 84°05'W, 1050-1150 m, INBio-ALAS, 9-iv-2001 (INBIO);

1 ♀, Costa Rica, Prov. Cartago, Paraíso, Est. Tapantí, Sondero Arboles Caídos, 1100-1200 m, 29 Mar 2011-19 Feb 2012, R. Zuñiga, C. More, Tp. [Trap] Malaise (INBIO).

Diagnosis. – This species is a dark brown to black species lacking metallic highlights (Fig. 47). It is the only dark species in which the mesepisternum is largely finely imbricate to coriaceous and where the head is about as long as wide (length 1.00-1.03× width). The holotype is carrying extensive pollen in the canistra of the propodeal lateral surfaces, the metafemoral scopa, as well as the scopal setae on metasomal sterna I–III. The male of this species remains unknown.

Discussion

The species of this subgenus were first reviewed by Engel (1995a), at which time four were recognized; now, 30 years later, at least 10 species can be recognized and given the sparsity of the sampling across suitable areas of occurrence, one would imagine that this number could perhaps double once again. The intensive collecting efforts of INBIO have produced the largest number of specimens and therefore the known species are concentrated in northern Costa Rica, specifically the Guanacaste, Tilaran, and Central mountain ranges (Fig. 50). A fewer number of specimens and species have been recorded from Panama, and then two specimens from the western foothills of the Andes in Ecuador, with material collected from elevations ranging from 1000 to 1650 m and most in lower cloud forest habitats. The exceptions are a single female of *C. perviridis* found at 478 m east of the mountains in Alajeula Province and several females of *C. perpectinata* captured at Barro Colorado Island. Extensive sampling at suitable elevations throughout the Cordillera de Talamanca and San Blas, on the peninsulas Nicoya, Osá, and Azuero; and in the Darien should recover important biogeographical occurrences and undiscovered species. Perhaps even more interestingly would be surveys for *Ctenaugochlora* through the slopes of the Andes in western Colombia and Ecuador, thereby filling the extensive gap between eastern occurrences for *C. perpectinata* and *C. algeri* and the much more southerly *C. isaaci*.

The densely pectinate inner metatibial spurs are certainly distinctive of the subgenus but identical forms do exist elsewhere among the bees, such as *Chlerogella* (*Ischnomelissa*) Engel, 1997b. It is unclear to what purpose these spurs are set to use and thereby necessitating their characteristic morphology. As the metatibial spurs are often used in grooming pollen it is possible that species with such spurs tend to visit floral species in which the pollen grains are single and exceptionally small. It is possible that the density of the spurs along with the expanded base, with the mesal surface arched and thereby weakly basin-like, serves to better capture the tiny monads. If this were the case, then the floral record of *C. perpectinata* at flowers of *Clethra lanata* (M.Martens et Galeotti) (Ericales) would be in agreeance with such a null hypothesis as the monadic pollen of Clethraceae (*Clethra* Linnaeus and *Purdiaea* Planch.) can range from 14-20 µm (Zhang & Anderberg, 2002). Interestingly, the distance between branches of the spurs of *Ctenaugochlora* range from 10-12 µm and therefore too narrow for such pollen grains to pass. Conversely, in the more usual pectinate spurs of *Caenaugochlora* this same distance is around three times as great and would be less efficient for combing such pollen. Naturally, this would only be consistent if species of *Ctenaugochlora*, and perhaps other genera with similar spurs, were oligolectic on flowers with such pollen morphologies, or at least an increased tendency toward such inflorescences. Most augochlorines, where known, are polylectic and there are virtually no data on pollen preferences for any *Caenaugochlora*, let alone the far-less-common species of *Ctenaugochlora*. Considerable fieldwork is needed regarding the pollination and nesting biology of *Ctenaugochlora* before any conclusions can be drawn but hopefully this work shall spur (pun intended!) melittologists to survey for these remarkable bees.

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Fig. 50. Map of occurrences for species of ***Ctenaugochlora*** Eickwort.

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Table 1. Checklist of species currently classified in ***Caenaugochlora*** Michener, 1954 *s.l.* (Augochlorini). Asterisks indicate type species.

subgenus ***Caenaugochlora*** Michener, 1954 *s.s.*

C. aequilanx (Vachal, 1904)
C. amatitlana (Cockerell, 1912)
C. chaetops (Vachal, 1903)
C. costaricensis (Friese, 1916)
C. cupriventris (Vachal, 1904)
C. cyanella Engel, 2009b
C. elisabethae Engel, 1997a
C. elpidia Engel, 2014a
C. flagrans (Vachal, 1911)
C. fulgur (Vachal, 1904)
C. gemmella (Cockerell, 1912)
C. gonzalezi Engel, 2014b
C. hestia Engel, 2014b
C. inermis (Vachal, 1904)
C. jeffreyi Engel, 1997a
C. leoi Engel, 2014b
C. macswaini Michener, 1954*
C. pantochlora Engel, 2014a
C. silvicola Engel, 2007
C. tonsilis (Vachal, 1904)
C. wilmattae (Cockerell, 1912)

subgenus ***Ctenaugochlora*** Eickwort, 1969

C. algeri Engel, 1995a
C. beethoveni Engel, 1995a
C. donnae Engel, 1995a
C. formosa **n**. **sp**.
C. incompleta **n**. **sp**.
C. isaaci Engel, 2019
C. mediopolita **n**. **sp**.
C. perpectinata (Michener, 1954)*
C. perviridis Engel & Gonçalves, 2010
C. raritas **n**. **sp**.

subgenus ***Metaugochlora*** Engel, 2014b

C. bennetti Gonçalves & Engel, 2010*
C. quichua Gonçalves & Engel, 2010

Résumé

Engel M. S., 2025. – Révision du sous-genre néotropical *Ctenaugochlora* (Hymenoptera: Halictidae). *Faunitaxys*, 13(28): 1 – 15.

Le sous-genre *Ctenaugochlora* Eickwort (Halictinae : Augochlorini : *Caenaugochlora* Michener) est révisé. Plusieurs nouvelles mentions de *Caenaugochlora* (*Ctenaugochlora*) *beethoveni* Engel, et de *C.* (*C.*) *perviridis* Engel et Gonçalves sont rapportées. Quatre nouvelles espèces du Costa Rica sont décrites : *C.* (*C.*) *incompleta* Engel **n**. **sp**.; *C.* (*C.*) *raritas* Engel **n**. **sp**.; *C.* (*C.*) *formosa* Engel **n**. **sp**.; et *C.* (*C.*) *mediopolita* Engel **n**. **sp**. Une clé de classification est fournie pour le sous-genre.

Mots-clés. – Anthophila, Hymenoptera, Halictidae, Augochlorini, *Caenaugochlora*, taxonomie, espèce nouvelle, description, Costa Rica.

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Illustration de la couverture :
Caenaugochlora (*Ctenaugochlora*) *formosa* **n**. **sp**. Paratype ♀.

Crédits:

Michael S. **Engel** : Fig. 1-50 & couverture.

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